A PRACTICAL GUIDE

TO

THE COLLODION PROCESS

IN

PHOTOGRAPHY;

DESCRIBING

THE METHOD OF OBTAINING COLLODION NEGATIVES, AND OF PRINTING FROM THEM.

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PREFACE.

THE object of the following pages is to give a clear and concise description of the method of producing Negative pictures on glass by the Collodion process, and of printing Positives from them upon paper.

It was written originally for the guidance of private pupils; because the author could find no good elementary treatise, not over-burdened with formulæ, or with too much purely scientific matter. He has been induced to give it a wider circulation than he originally intended, by the hope that, from its practical nature, it may be useful to others who are commencing to practise this fascinating art.

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GUIDE TO PHOTOGRAPHY.

General Description of the Collodion Process.

BEFORE entering into the details of the Collodion process, it may be well to give a summary, to enable the beginner to recognise the chemical changes involved in it, and to understand the few technical phrases which are unavoidably used in the lengthened description. This summary, and a few practical hints on the chemicals and instruments required, shall be given in as few words as possible.

The picture obtained on a plate of glass, in the first part of the process, when looked at by transmitted light, has the lights and shadows of nature reversed—the shadows being white, and the lights black. It is spoken of as a *negative picture*, or a *negative*.

The finished picture obtained from this negative in the second process, by super-position on paper, has its lights and shadows as they are seen in nature. To

distinguish this from the negative, it is called a *positive picture*, or a *positive*.

The *negative* is thus produced. A clean glass plate is first coated with a solution of gun-cotton in sulphuric æther (Collodion), containing a small proportion of alcohol and iodide of potassium, and is then dipped into a solution of nitrate of silver. The iodine, of the iodide of potassium contained in the collodion, and the silver, of the nitrate of silver, combine and form a light yellow coating of iodide of silver, which remains on the surface of the plate with unchanged nitrate of silver. These salts render the collodion surface very sensitive to light, or rather to the invisible chemical rays which accompany the coloured rays of light.

A plate, thus prepared in a darkened room, is placed in a Camera Obscura, so that the image of some object placed in front of the camera may be formed on its sensitive surface. After exposing the plate in this way for a certain time to the action of the rays of light forming the image, it is again taken into the darkened closet; and although, on removing the plate from the frame which held it in the camera, no visible change is observed, a chemical change has nevertheless been produced on the collodion surface to an extent varying according to the amount and quality of the light forming the different parts of the image in the camera. To

bring out or develope this latent picture, a developing solution composed of pyrogallic and acetic acids is poured on the plate. The effect of this is permanently to blacken the deposit on the collodion surface in the position of the image. The depth of tone in this black deposit varies with the intensity and quality of the light reflected from the different parts of the object, and, consequently, a picture or representation of the latter, embracing even its most minute details, is produced. But the lights and shadows are reversed when the picture is viewed as a transparency; for the light parts of the object which reflected a large number of rays of light have blackened the collodion surface very deeply, whilst the shadows which reflected but a feeble light have darkened the collodion surface but feebly.

When the blackening has attained sufficient intensity, the developing solution and the nitrate of silver are washed off, and the negative will then bear exposure to daylight without injury. Before it is fit for printing or producing a positive, the unchanged yellow iodide must be removed from the surface of the plate. This is accomplished by immersing it in a solution of hyposulphite of soda, which in a few seconds dissolves the yellow iodide of silver and leaves only the blackened deposit, which produces the representation of the object. The negative is then well washed with water

to remove the hyposulphite, and, after being set aside to dry, it is finished.

The *positive picture* is obtained from the negative in the second process. A sheet of paper is coated first with a solution of common salt or of chloride of ammonium, and when this is dry, with a strong solution of nitrate of silver; a coating of chloride and nitrate of silver is thus formed on the surface of the paper which is again dried. Wherever the light shines upon this paper it exerts a chemical action, and gives the paper a brown or black colour, of an intensity varying according to the length of time the exposure has been continued and the character of the light at the time.

The negative is then laid upon a sheet of paper so prepared, and these are pressed into close contact by a plate of thick glass laid upon them, or by a frame with a glass front prepared for the purpose. In the position of the shadows of the object copied, where there is little or no deposit upon the negative, the light acts quickly upon the prepared paper and changes it to a deep brown or black colour, before the portions of the paper protected from the light by the more opaque parts of the negative are at all effected. If the paper were taken from beneath the negative in this state, and exposed to daylight, it would, in a short time, turn equally brown or black over the whole surface.

To prevent this, and to fix the positive picture, after it has become sufficiently dark, it is placed in a solution of hyposulphite of soda. This acts upon it as upon the negative, dissolving the salts of silver from those portions of the paper which were covered by the opaque parts of the negative, and consequently were not acted upon by the light, leaving only the permanent blackened chloride which forms the picture.

The hyposulphite is then removed from the paper by repeatedly washing it with clean water, and, after being dried, the picture is finished.

The Apparatus and Chemicals required in the Collodion Process.

THE following list comprehends the principal articles necessary for the successful practice of this branch of Photography :—

A Double Achromatic Lens, for Portraits.
A Single Achromatic Lens, for Landscapes.
Sliding Camera on a tripod stand.
Glass Bath for holding solution of nitrate of silver.
Flat Porcelain Bath for preparing paper.
Pressure Frames for printing.
Glass Funnel for filtering solutions.

Graduated Measure and small Scales and Weights.
Pure Nitrate of Silver (Crystallized).
Collodion.
Pyrogallic Acid.
Glacial Acetic Acid.
Chloride of Gold.
Spirits of Wine.
Plate Glasses to fit the slides of the Camera.
Photographic Paper,
And a Piece of Wash Leather.

PHOTOGRAPHIC LENSES.

BEGINNERS are often at a loss how to choose their lenses, owing to the great number of eminent opticians who have devoted their attention to their construction since the art became popular, and to the differences of opinion amongst Photographers as to the comparative merits of particular lenses, even after they have made use of them for some time. Those manufactured by Mr. Ross of London, judging from the eminence of the maker, and the high price he charges for them, appear to take the lead.

But, though unsurpassed in several important points, such as their quickness of working, and the coincidence of the foci of their chemical and coloured rays, Mr. Ross's lenses will, in practice, frequently be found to give too sharp a focus. Thus, if in taking a

half-length protrait with one of Ross's whole plate lenses, on a moderately clear day, you bring the eyes, nostrils, and mouth of the sitter in focus on the ground glass of the camera, you will find that the ear is slightly out of focus, and the hair at the back of the ear entirely so, the field being, as it were, only an inch or two in depth. Performing the same experiment with a lens of the same diameter by Lerebours and Secretan of Paris, the whole head is in focus, and the other parts of the figure are less distorted. Such lenses have the disadvantage, however, of being slower in their action than Ross's, but when rapidity is only of secondary importance, Lerebours' lenses, from their superiority in the important point before mentioned, are certainly to be preferred.

The lenses made by Voigtlander, and some other Continental and English makers, though possessing some good qualities, have different foci for their chemical and visual rays. These lenses are very troublesome to work with; for after focussing the picture produced on the ground glass by the visual rays, it is necessary to bring the lens nearer the ground glass, to an extent varying with the distance of the sitter from the lens, before the chemical rays, which are to act on the collodion surface, will be in focus upon it.

For landscapes, when the difference of a few se-

conds of time in the working is of little consequence, the lenses manufactured by known French makers are always to be preferred; as the general superiority of the views produced by these lenses proves. They have the additional recommendation of being cheaper in price.

THE CAMERA.

THE Camera should be made of hard wood to prevent its shrinking, and it should be capable of adjustment both for protraits and landscapes.

It is essential that the frame of the camera holding the ground glass plate, and that which is to hold the collodion plate, be so fitted, that when in the camera, the inner surface of the ground glass on which the object is focussed, and the collodion surface of the collodion plate, be precisely at the same distance from the lenses. If this is not the case, it is very difficult to obtain a good picture; because, a well defined image cannot be produced either upon the ground glass or the collodion surface, unless it be exactly in the focus of the lenses, and to allow for a difference in the position of the ground glass and collodion plate in an ill constructed eamera is so difficult, that a good picture cannot be expected in the use of such an instrument except by mere accident.

To test a camera on this point, withdraw the ground glass frame after focussing the picture by its means, and insert the dark frame, containing another piece of ground glass, instead of the collodion plate. By opening the back of the frame and drawing up the front part, you can see at once if the image is as distinct upon this second ground glass as upon the first one, and if not, the dark frame must be altered accordingly.

When using the camera it must always be perfectly level, otherwise horizontal and perpendicular lines, such as occur in buildings, &c., would be drawn obliquely in the picture. A few perpendicular lines drawn in pencil on the focussing glass will be found useful; and if different sized pictures are to be taken by the same instrument, the exact dimensions of the various sized plates should be drawn in the same way upon the ground glass.

CHEMICALS.

It is of great consequence that the chemicals be pure. The only way to insure this is to purchase them from a respectable dealer, and pay a sufficient price for them.

Economy in this matter tends only to create disgust with the art; for where impure chemicals are used none but inferior pictures can be produced.

It is especially advisable that collodion should be purchased from some person who has devoted considerable attention to its production.

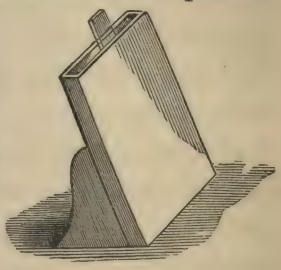
Beginners often fancy that they have no merit unless they not only produce good pictures, but also manufacture their own chemicals. Painters find it better that their whole energies should be spent in designing their pictures, and applying the colours with effect on the canvas, than that they should waste their time in preparing and grinding their pigments. The latter departments they leave to the colour man, whose proper business and interest it is to see that they are properly prepared and perfectly ground. So should it be in Photography, where the most expert manipulator finds himself taxed to the utmost to obtain perfect results, with every requisite prepared to his hand.

The collodion prepared by Mr. Thomas, Pall Mall, is, undoubtedly, the best for negatives that has yet been manufactured in this country; and, though professional photographers say little about the matter, there is but little doubt that it is used in every establishment in the kingdom where first-rate pictures are executed. Messrs. Horne and Thornthwaite, of Newgate Street, and some others, make good collodion at a much cheaper rate, but for certainty of working and uniformity of quality, the xylo-iodide of silver, sold

by Mr. Thomas, is still unrivalled; and, taking into account the number of failures, and the annoyance attending the use of second-rate collodion, I have little hesitation in saying that it will be found in the end to be the cheapest.

BATHS.

THE bath for holding the nitrate of silver solution may be either horizontal or vertical, but the latter form has so many advantages over the former that it is generally preferred. The collodion surface of the plates is inverted on the surface of the solution in the horizontal bath, and the plates are immersed in the solution when the upright bath is used, by placing them on a long slip of glass, with a cross piece fixed at one end to prevent them slipping off. The accompanying sketch shows the form of this bath, with the glass dipper inserted. Its use will be more fully explained afterwards.



WORK-ROOM.

AMONGST the other things required in the practice of Photography is a darkened closet; for, as light is the active agent employed to produce a picture, it will prove destructive if admitted during the process of dipping and developing the plate. The closet prepared for the purpose should be lighted only by a pane of yellow glass, or by one of common glass covered with three or four folds of yellow calico. It is more convenient if the light be admitted below the level of the hand in working, as the progress of developing the negatives can then be watched with greater ease and certainty.

Detailed Description of the Collodion Process.

METHOD OF PRODUCING THE NEGATIVE PICTURE.

HAVING described the various articles required in this branch of Photography, it is necessary to point out, in the next place, how these are to be employed in the various steps necessary for the production of pictures.

SELECTING AND CLEANING THE PLATES.

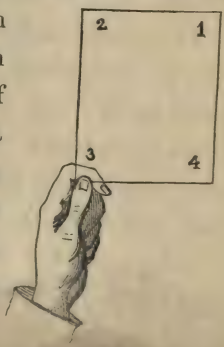
THE plates selected should be of patent British plate glass. They should be free from striæ, and although it is not absolutely necessary, it is better that they should be ground on the edges before being used, as this prevents the film of collodion from tearing at the edges. The plates should be laid flat on a board covered with cloth, and cleaned by pouring on a few drops of spirits of wine and rubbing immediately in a circular direction with a soft cloth, polishing first one side and then the other. Remove them to a clean board prepared as above, laying the side of the plate first cleaned uppermost, and after a second application of the spirits of wine, take a piece of chamois leather,

roll it up into a ball, and polish again, breathing upon the plate during the process, until you find that the vapour of the breath adheres equally over the whole surface. Turn the plate and treat the other side in the same way. The plates should then be put away in a box for use, taking care to handle them only by their edges.

New chamois leather should be well washed in a strong solution of common soda and water, to remove the oil and grease which it contains. The soda must then be well washed out by several changes of clean cold water. After the leather is dry, stretch and rub it until it becomes perfectly soft and flexible.

COATING AND EXCITING THE PLATES.

When the plates are about to be used hold them in the left hand by one corner, as in the annexed diagram, covering with the thumb as little as possible of the surface of the glass, and with a clean dry leather wipe the surface lightly to remove any loose particles of dust which may adhere to it, and which would have the effect of causing small black specks and comet-



like marks on the finished picture. Then, having taken the bottle containing collodion in the right hand, remove the stopper with the little finger of the left hand, and taking care that no dry collodion is sticking about the mouth of the bottle, immediately proceed to pour the collodion upon the centre of the plate in a full equal stream until there is rather more than sufficient to cover it. Depress the corner, No. 1, and allow the collodion to run to the edge; do the same with No. 2; then allow the collodion to flow towards No. 3, and if possible let it skirt the thumb without touching it; lastly let it drain into the bottle. To prevent the collodion running into streaks or furrows it is necessary, during the process of draining, to move the plate slowly to one side, by either depressing or raising the left hand; and if this is done carefully, the film of collodion will then present a smooth equal surface.

Soon after the collodion ceases to drip, replace the stopper of the bottle, and seizing the plate by its edges, and near the upper end, between the middle finger and thumb of the right hand, lay it on the glass dipper and plunge it slowly but without stopping in the following bath, and cover it to exclude the light.

Into a 16 oz. stoppered bottle put

Nitrate of Silver, ...	1 oz.
Distilled Water, ...	2 oz.—*Dissolve.*

Into another bottle put

Iodide of Potassium, . .	4 grains.
Distilled Water, . . .	2 drachms.—*Dissolve.*

Mix the two solutions and shake them until the precipitate which is formed is again dissolved, then add

Distilled Water, . . . ,	14 oz.

Allow the mixture to stand for half an hour, and then filter through clean white blotting paper, and add

Alcohol, ...	2 drachms.
Æther, ...	1 drachm.

After working sometime with this bath a little fresh solution of nitrate of silver (60 grains to an oz. of distilled water) must be added to it now and then, to keep up its original strength. When it requires strengthening, it will begin to give weaker negatives than it did at first, and the plates will require longer immersion to take up a sufficient coating of iodide of silver.

The solution should be kept above the temperature of 50° Farenheit, and carefully excluded from the light whilst it is used.

Distilled water must be employed for every solu-

tion in which nitrate of silver is present, as the salt contained in common water decomposes it.

The hands should be washed and dried after fixing a negative, before the dipper or the iodized plates are again touched, to prevent hyposulphite of soda or any other foreign substance running down the dipper and spoiling the bath.

The dish containing the solution should be made of solid glass or of gutta percha, as those made of porcelain or stoneware soon become useless from the glazing giving way. It should be washed out when necessary with distilled water.

After the plate has been from 3 to 5 minutes in the bath remove the cover, and by means of the dipper lift the plate up and down in the solution, until the collodion surface ceases to have a greasy appearance, and the solution adheres smoothly and equally over it. These appearances indicate that the plate has received a sufficient coating of iodide of silver, and that it is ready to be placed in the camera. With Thomas's collodion, 5 minutes immersion in the bath in moderately warm weather, and 10 to 15 minutes in winter, will not be found too long. This lengthened immersion increases the quickness of action, and ensures the equal development of the parts of the picture after exposure in the camera.

EXPOSING THE PLATE IN THE CAMERA AND SUBSEQUENT DEVELOPMENT OF THE PICTURE.

As no practical method has yet been discovered for testing the power of the chemical or actinic rays of light, no particular time can be specified for exposing the plate to the image in the camera.

The time varies so much with the season of the year, hour of the day, &c., that a different exposure may be necessary on particular days almost every quarter of an hour. In spring, summer, and autumn, the time of exposure will range from 2 to 30 seconds, and in winter from 10 to 100 seconds, when a double achromatic lens is used.

A diaphram having a very small aperture is used in front of a single achromatic lens when it is wished to obtain a well-defined picture of near and distant objects at the same time. If the aperture of such a diaphram be half an inch in diameter, and the focal length of the lens about 16 inches, the time of exposure of the plate will vary from 5 seconds to 5 minutes.

Those who have had a little experience can judge from the appearance of the image in the camera what period of exposure will be necessary within a few seconds; but so delicate is the operation of exposing

the plate, that at times, even one or two seconds too long or too short, will be sufficient to spoil the beauty of a negative, which, had it been exposed the precise time necessary, at that particular hour or season, would have been perfect.

The plan most generally adopted is to expose a plate for a particular time, and then from the appearances which it presents during and after the development of the picture, one can tell almost to a second, the period of exposure necessary to produce a good negative on the second trial. As beginners, however, have often great difficulty in determining from the appearance presented by a finished negative, whether it has had *too short* or *too long* an exposure, and as this is a point of the greatest importance, I shall endeavour to be as precise as possible in pointing out how the two different effects may be distinguished.

Many a beginner has wasted his time, exhausted his patience, and blamed first the bath, then the collodion or lenses, as the cause of his failures, when, had he known from the appearance of his negatives, how long to expose the plates, he would have found everything in good working order, and produced capital pictures. Here lies the greatest difficulty in attempting to take views in the fields, upon collodion plates previously prepared; as out of 20 so treated, when brought home

and developed, not one may be found which has been exposed so nearly the proper time that it may be rendered fit for use.

Supposing then that you have arranged your sitter or subject, say for a protrait of a lady dressed in a black silk dress and a white cap, and that you have gone through the operation of exposing the first plate in the camera; withdraw the dark frame containing the plate, take it into your darkened closet, remove the plate, and holding it in the left hand, as during the operation of coating it with collodion, proceed to pour on the surface as much of the following solution as will suffice to cover it, and keep moving the plate to make the solution flow from end to end without spilling.

Pyrogallic Acid, ...	1½ grains.
Water, ...	1 oz.
Glacial Acetic Acid, . .	½ drachm.

Mix, and to every ten ounces of the solution add two drachms of spirits of wine.

If the plate has had *too short* an exposure in the camera, the high lights about the cap, hands, and face will soon make their appearance, and will go on increasing in blackness until they get *very intense*, before the figure and back-ground make their appearance.

Should the developing solution be kept on for some

time longer in the hope of bringing up the details of the figure, it will be found that before this result is obtained, the middle or *half tints of the face and hands will be merged in the lights, and consequently lost;* so that when the plate is used for printing, the proof or positive will present a very harsh picture, almost solely composed of bright lights and deep shadows.

On the other hand, if the plate has had *too long* an exposure, the image will appear quickly on applying the developing solution, but the whole will increase in intensity to nearly the same exent—that is to say, the dress, back-ground, &c., will get as dark or nearly so, as the face and hands; but however long the process of developing may be continued, it will be found impossible to get a sufficiently deep negative to print from.

A plate thus treated will generally appear of a beautiful purple or crimson colour or looking through it, and it will *always present so thin a deposit*, that unless it has been but slightly over exposed it will prove useless as a negative. An impression printed from this plate would have quite an opposite effect from the first one; for instead of being composed of bright lights and deep shadows, it would be *almost all middle tint;* the face, dress, and back-ground, being of a uniform grey color, with very minute details. The negative will present the above-named indications in a greater or less

degree, in proportion to the amount of over or under exposure of the plate to the rays of light in the camera. You may always calculate, however, that the plate has had *too short* an exposure if the face and cap become of *too intense a black before the details of the dress are distinct;* and that it has had *too long* an exposure if the *details of the dress are very distinct, and the deposit on the face and cap is too thin as a negative.*

It must be borne in mind, that in speaking of lights or shadows, reference is made, not to the lights or shadows as they appear on the negative, where they are reversed, but to the lights and shadows of the object in nature, or of the positive picture, printed from the negative upon paper, prepared with nitrate of silver.

If a plate has been but *slightly under-exposed*, a tolerably good negative may be got by watching the lights narrowly, and stopping the development as soon as the half tints show the least indications of being lost in the lights. If the plate has been only *slightly over-exposed*, a very good negative may be procured by keeping on the developing solution as long as it appears to act, and then having poured it off, by applying a fresh quantity of the developing solution, with two or three drops from the nitrate of silver bath added to it. Thus the intensity of the negative may be considerably increased.

In taking views, where minute detail is desirable, it is better that the plate should be rather *over* than under-exposed, and then treated in the manner just indicated.

It will also be found that, in cold weather, a stronger solution of pyrogalic acid is required for the developing agent—sometimes as much as 3 or 4 grains to the oz. of water. A good plan, and one often adopted, is to prepare the developing agent thus :—

Pyrogallic Acid, . . .	3 grains.
Water, ...	1 oz.
Glacial Acetic Acid, . . .	1 drachm.

Mix, and add 2 drachms of spirits of wine to each 10 oz. The spirits of wine added to the developing agent makes it flow evenly over the plate, and it should be added in greater quanity if the above is found not to be sufficient.

When about to use this solution, pour half the quantity necessary to cover the plate into a clean glass measure, adding water for the other half. If, after trial, this does not appear to be strong enough to develope the negative sufficiently, pour a little of the strong solution from the bottle upon the plate, and this will at once deepen it sufficiently.

If the plate has had the proper time of exposure,

the image will appear more slowly ; and soon after the lights make their appearance, the outline of the whole picture will be distinguished. As you continue the developing process, the high lights will grow intense; the lights about the hands and face will also continue to blacken ; and, lastly, by the time the face is of such a depth as you desire, and before the half tints have become obscured, the whole of the details about the dress and back-ground will have become sufficiently distinct, while the most intense shadows will retain their purity and clearness. An impression printed from this plate should present nearly a perfect facsimile of the sitter in light and shade, the highest lights on the cap and forehead, and the deepest shadows of the dress and back-ground, being united by the soft gradation of middle tint seen in every well illuminated object in nature.

In taking a portrait, the sitter should be placed in a good light, which should be arranged so as to bring out the features to the best advantage, with neither too much nor too little shadow. The light from the north or east is preferable, from its being less liable to the influence of atmospheric changes. If direct sunshine were used, the shadows would be too harsh and black, and the strong glare would also be disagreeable to the sitter. It is sometimes necessary to work in sun-

shine when groups of figures or animals are under treatment, as they can thus be taken in a shorter space of time; and a sunlight effect is often desirable in landscapes and buildings, if care be taken to give the negative sufficient exposure. In placing a sitter, an easy and graceful position is almost all that is required;* but this is often a matter of some difficulty, as from want of depth of field in the lenses, every part of the figure must be brought as nearly as possible on the same plane. The side should be turned to the instrument, so as to place the hands and head at nearly the same distance from the lenses. The distortion that would otherwise arise from objects within and beyond the focal distance, is thus in a great measure obviated.

It is in placing a sitter, and in choosing the best or most picturesque portion of a landscape, that a manipulator who has a knowledge of art, is superior to the mere mechanic; but beyond what has been already said, it would be needless in a short treatise like this to attempt to give useful instruction in a matter which after all that could be written upon it must be left in a great degree to the individual taste and judgment of the operator.

* Those who are anxious for further information on this subject, may consult "Composition in Painting," "Hints on Portrait Painting," and "Light and Shade in Painting," by John Burnet, or "Hints on Art," by J. D. Harding.

FIXING THE NEGATIVE PICTURE.

THE instant that the picture has been developed to the proper point, pour some clean water on the plate to remove the acids, and when this has been effected, you may remove it to the daylight, and proceed with the next operation.

Make a solution of hyposulphite of soda, by half filling a pint bottle with hot water, and adding the hyposulphite until no more will dissolve. Decant this into a flat gutta-percha dish, and immerse the plate in it. In a few seconds the whole of the yellow iodide will be removed, leaving only the blackened deposit, which forms the negative. Take the plate out of the dish, and continue washing it with clean water, by holding it horizontally and allowing a gentle stream to fall on the centre, until every trace of hyposulphite is removed, when the plate may be placed in the sun, or near the fire to dry.

If any hyposulphite is left on the surface, it will recrystallize and spoil the negative and every impression that may be printed from it, the hyposulphite forming dirty metallic streaks when placed in contact with the nitrate of silver on the surface of the paper. This cannot be got rid of in any after stage of the treatment.

When the plate has been thoroughly dried, it is better that the collodion side should be protected by a coating of varnish, if it is intended to print many copies from it, although with a little care twenty or thirty copies may be printed without this precaution. Amber varnish is the best for this purpose; and it may easily be prepared in the following manner. Pound in a mortar $\frac{1}{4}$ oz. of pure amber, put it into a 4 oz. bottle, and fill up the bottle with chloroform. Cork it tightly, and place it in a warm place for 12 hours, shaking occasionally; then, filter through blotting paper into a clean bottle, and it is fit for use. Although the amber does not appear to have lessened in bulk, there is still as much of it dissolved as will form a sufficiently strong varnish. Apply it on the plate in the same manner as collodion, but let it rest for a little on the surface of the glass before draining into the bottle, that the chloroform may have time to evaporate, and leave a thicker coating of varnish.

The plate dries almost immediately; and it is then ready for printing.

METHOD OF PRODUCING THE POSITIVE PICTURES.

THESE pictures have lights and shadows corresponding with those of natural objects. They are obtained by photographic printing on paper, specially prepared for the purpose, the negative picture being used in lieu of types, the chemical action of light in the place of the printers' ink, and the pressure frame instead of the printing-press.

PREPARING THE PAPER.

ANY white wove writing paper will answer the purpose, if of even texture and tolerably free from metallic specks. But, as many manufacturers have now turned their attention to the preparation of paper for photographic purposes, it is better to purchase this at once. Canson Fréres', Turner's, and Whatman's are the papers most in repute, the first named being generally preferred for positives. I have recommended the beginner to purchase collodion for taking the negatives in preference to preparing it for himself, and I would now advise that the papers for taking positives should also be purchased ready salted and albumenized. Owing

to the constant demand for such paper, it can be prepared cheaper and better on the large scale than any one can expect to prepare it for himself, except after repeated trials and great waste of material.

Pictures printed on albumenized paper have generally greater clearness and depth in the shadows, and more detail than those on simple salted paper. Many prefer the latter, on account of its peculiar softness of effect; and, therefore, a short account will be given of the method of preparing both kinds of paper, in order that those who wish to prepare either kind, may be enabled to do so with a fair chance of success.

ALBUMENIZED PAPER.

TAKE a sheet of Canson's thick positive paper; cut it into sizes a little larger than your negatives, and proceed as follows:—

Into a basin put

The Whites of . . .	8 fresh Eggs.
Water, ...	8 oz.
Chloride of Ammonium, .	200 grains.

Beat with a silver fork or a bunch of quills into a firm froth, cover the dish to keep out dust, and set it aside for 12 hours. When ready to proceed, pour off the clear liquid into a flat porcelain dish, and see that no

air bubbles or dust are floating on the surface. Take one of the pieces of paper, and, having turned down half an inch, or dog-eared it at two opposite corners, hold the sheet by these corners, and bend it so as to allow the middle to touch the solution first; then gradually bring down the ends of the paper in turn, taking care that none of the albumen runs over the upper surface.

Take hold of the paper immediately afterwards by one of the bent corners, and lift it up sufficiently to allow you to see that no air bubbles prevent the albumen from coming in contact with the paper. If there are any bubbles, remove them with a soft camel's hair pencil, and float the paper again as before. After five or eight minutes, tear it up suddenly to bring a good coating of the albumen with it. Allow it to drain for half a minute, and then pin it up away from the fire to dry. If placed near a fire, or in a warm place, the albumen will set before it has drained sufficiently, and the surface will be streaked in consequence.

In preparing the albumen, the yolk and germ should be carefully excluded, and the eggs should never be more than a week old. After it has been frothed up and allowed to settle, the albumen will not keep more than a day or so, and it should therefore be used up at once. It will save time if sheets, twice or

four times the size of the negatives, are prepared in a larger dish, as they may afterwards be cut to any required size.

Thus far the paper may be prepared in daylight, and it will keep in this state for months if, after being thoroughly dried, it is not allowed to get damp. When required for use, float the sheets by candle light in the same way as before, and for the same length of time, upon a solution of nitrate of silver of the following strength, and hang them up to dry in the dark :—

Nitrate of Silver, . . .	60 grains.
Distilled Water, . . .	1 oz.

The chloride of ammonium on the surface of the paper and the nitrate of silver contained in the above solution combine and produce chloride of silver, which remains on the paper, with a little unchanged nitrate of silver. When light is allowed to fall on these salts, a chemical action ensues and the paper is blackened, therefore, after drying the paper, it must be kept in a portfolio to exclude the light until it is required for use. The best impressions are obtained after the paper has been prepared about 12 hours, but it will keep good for two or three days. After this it begins to blacken even in the dark.

PLAIN SALTED PAPER.*

THIS may be prepared to print of any shade of black or brown that may be desired, by floating Canson's paper first upon a solution of common salt, or of chloride of ammonium, allowing it to dry, and then floating it upon the solution of nitrate of silver as before named, varying the strength of each according to the tint desired in the finished proof.

For a light sepia tint, float first upon a solution of

Chloride of Barium, or Common Salt,	10 grains.
Water, ...	1 oz.

Allow the paper to remain for 5 minutes, hang it up to dry, and then float it on a solution of

Nitrate of Silver, ...	50 grains.
Distilled Water, ...	1 oz.

If a deeper colour be required, use for the first,

Chloride of Ammonium, . . .	14 grains.
Water, ...	1 oz.

* Paper ready salted and albumenized in a variety of ways may be bought at a reasonable rate, from A. Marion & Co., 156, Regent Street, London. With each packet of this paper, directions are given as to the strength of the nitrate of silver bath which it requires.

And for the second,

Nitrate of Silver, ...	80 grains.
Distilled Water, ...	1 oz.

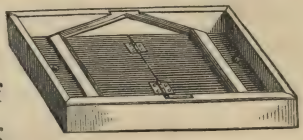
A black and white proof may be obtained by using for the first solution.

Chloride of Ammonium, . . .	20 grains.
Water, ...	1 oz.

And for the second,

Nitrate of Silver, ...	120 grains.
Distilled Water, ...	1 oz.

PRINTING FROM THE NEGATIVE.



THE annexed sketch represents the most convenient form of pressure frame for pictures less than 10 by 12 inches. It is a frame of hardwood, having a strong and fixed plate-glass front, and a wooden back hinged in the middle, for the convenience of lifting up one end to examine the progress of printing, without disturbing the paper upon the surface of the negative. The pressure is applied behind the back by means of two cross bars working in grooves, on the principle of the wedge.

This is all that is required, and it is certainly more simple than the cumbersome machinery of screws and levers, used for printing pictures of a larger size.

Take out the cross bars and the hinged back, which ought to be covered on the inside with cloth, lay the prepared paper on the cloth with its sensitive side uppermost, and over the paper place the negative with the collodion side touching the paper.

Raise the back with the paper and negative upon it by the right hand placed below the back, and then bring the frame with its glass front down upon the whole. Hold firmly, so as not to allow the negative to slip, and with a single movement of the wrists, turn the whole upside down. Lay the frame on a table, insert the cross bars or wedges, bringing them both home at the same time, and then remove to the daylight to print.

Although by placing the frame in the sunshine, in the summer time, the process of printing may be quickened, yet this never gives such clear impressions, as when the frame is placed in the shade, or in such a position as to command the maximum of clear blue sky. Better impressions are often obtained in winter when a whole day is occupied in the process, than can be got in summer even in the shade.

The depth to which the proofs require to be printed

varies so much according to the strength of the fixing and colouring baths, and the tone of color desired, that no definite directions can be given on this point; the deeper they are printed, however, the darker will the resulting tone be, and *vice versa*, whatever may have been the strength of the silver solution used in preparing the paper.

FIXING THE PROOFS.

HAVING printed your pictures as deeply as you think necessary, remove them from the pressure frame and plunge them quickly into a basin of clean water and cover them up from the light. Soaking the proofs in water before placing them in the colouring bath, may be dispensed with, and many prefer immersing them in the latter at once; but I have always found that when they are thus treated, the shadows of the finished pictures are never so clear and transparent. After the proofs have been for about half an hour in water, remove them to the colouring bath, and in doing so, take care that your fingers are perfectly free from hyposulphite of soda, otherwise the proofs will be instantly spoiled by brown metallic streaks.

The colouring bath may be prepared in a variety

of ways, but the following I have found to be all that is necessary, and the most simple—

Hyposulphite, of soda, . .	3 oz.
Water, ...	20 oz.
Chloride of Gold, . . .	10 grains.

The hyposulphite and water should be mixed first. The chloride of gold should be dissolved in about 1 oz. of water and added gradually, stirring the bath during the operation.

This bath will colour rather slowly at first, but every additional proof fixed in it will increase the radidity of its action by adding chloride of silver to it. When new and in its full strength, the proofs will be lightened in tone to a greater extent than after it has been for sometime in use, and they will require to be more deeply printed to allow for this reaction, After the bath has been in use for some time, the proofs will bear to be less deeply printed, but in every case the highest lights ought to be allowed to assume a more or less intense violet tint before they are removed from the pressure frame. As after fixing a good many poofs, the bath will get weakened, both in chloride of gold and hyposulphite; these must be added in small quantities now and then to keep up its working qualities in perfection. When too weak in chloride of gold,

the proofs will have to lie in the solution for a longer period before they assume the desired tone or lose the foxy brown colour. To remedy this, a few drops of solution of chloride of gold should be added.

When the bath is weak in hyposulphite the proofs often appear of a dirty yellow colour when finished, and in this case, the bath should be strengthened by adding a few crystals, or by pouring a little of the fixing bath into it. This yellowing will also take place if the proofs are allowed to remain *too long* in the colouring or fixing solutions. In general, they should be removed from the former when they begin to change to a slightly purplish brown colour.

When of this colour, wash them once or twice in clean water, and place them in the fixing bath, which is composed of a solution of hyposulphite of soda in water, in the proportion of three ounces of hyposulphite to twenty ounces of water. The proofs are partly fixed during the operation of colouring—the second bath is to insure their being perfectly fixed, by removing any soluble salt of silver that may not have been acted upon in the first bath.

The fixing bath also deepens the tint of colour of the proofs, which requires to be taken into consideration in removing them from the first bath.

The proofs should remain in the fixing solution from

ten minutes to half an hour, being carefully watched that the lights and middle tints be not too much reduced. You then remove them into a large dish of clean water to be washed.

A fresh *fixing bath* requires to be made now and then, say after fixing fifty or sixty pictures, 10 in. by 8 in. The old bath should not be thrown away, but poured into the colouring bath.

Although the process of printing and fixing becomes simple after a little practice, it always requires constant attention in every stage, for neglect of a proof for ten minutes while in the pressure frame or either of the baths, is often sufficient to ruin it.

WASHING THE PROOFS.

WASHING the proofs after they have been fixed is rather a slow operation, as you cannot depend upon their being free from the compound of the hyposulphite and silver, if the water in which they are immersed is not frequently changed for at least twelve hours, and it is better even to prolong this time. Place them in a clean flat dish, and wash them well for a minute, by allowing the water to run over them, or by filling the dish and then allowing the water to run off again. Let them lie in the water for about an hour, then take

them out, drain them well by hanging them up for a short time, wash the dish well, and refilling it, place the proofs in it for another hour. Repeat the operation of draining the proofs, and renewing the water, every hour or so, for twelve hours or more; and then pin them up by the corner to dry. When the proofs have arrived at this advanced stage, great care must be taken not to touch them with fingers the least contaminated with hyposulphite of soda, nor allow anything which has touched this salt to come near them. The hyposulphite will infallibly eat out the impression wherever it touches it. The drying of the pictures may be hastened by holding them near a fire. When completed, their edges should be cut; and they may either be mounted on card by pasting them on the back with flour paste, or they may be kept unmounted in a portfolio.

TABLES

Of Weights and Measures, referred to in the foregoing pages.

APOTHECARIES' WEIGHT

20 grains	1 scruple
60 grains, or 3 scruples, . .	1 drachm
480 grains, or 8 drachms, . .	1 oz.
5760 grains, or 12 oz., . . .	1 lb.

APOTHECARIES' FLUID MEASURE.

60 minims	1 drachm.
480 minims, or 8 drachms, . .	1 oz.
9600 minims, or 20 ounces, . .	1 pint